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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/811,924	03/30/2004	Hiroki Yoshikawa	0171-1079PUS1	3156

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EXAMINER

ROSASCO, STEPHEN D

ART UNIT PAPER NUMBER

1756

DATE MAILED: 10/20/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/811,924

Applicant(s)

YOSHIKAWA ET AL.

Examiner

Stephen Rosasco

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 31 January 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-15, 19-21 and 24-26 is/are allowed.
- 6) ☒ Claim(s) 16-18, 22, 23 and 27 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
  - 2) ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>3/30/04</u> . | 6) <input type="checkbox"/> Other: _____  |

### Detailed Action

Claims 1-15, 19-21, 24-26 are indicated as allowable.

Reasons for Allowance – the prior art of record including Montonaga et al. (6,458,496), does not teach the claimed invention including the limitations of moderately graded composition between the layers.

The specification defines the term "moderately graded composition" between two adjacent layers means that there may be either a continuous or stepwise transition from the composition of one layer to the composition of the other layer. In the latter case, the term designates at least 5 steps, especially 10 to 50 steps of compositional transition from the substrate side to the surface side (for example, the Mo amount decreases sequentially in at least 5 steps, especially 10 to 50 steps and/or the Zr amount increases sequentially in at least 5 steps, especially 10 to 50 steps).

Montonaga et al. (6,458,496) teach a halftone phase shift photomask comprising a transparent substrate and a halftone phase shift film provided on said transparent substrate, wherein said halftone phase shift film has a multilayer construction in which at least a first layer capable of being etched with a chlorinated gas and a second layer capable of being etched with a fluorinated gas are disposed in this order from the side near said transparent substrate, and said halftone phase shift film also comprises apertures made by removing part of said halftone phase shift film in a prescribed pattern.

And wherein said second layer has an element composition comprising tantalum, silicon and oxygen as essential elements.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 16-18, 22, 23, and 27 are rejected under 35 U.S.C. 102(e) as being anticipated by Westerman et al. (6,544,696) or Angelopoulos et al. (6,682,860).

The claimed invention is directed to a photomask blank comprising a substrate and a multilayer film thereon including at least four layers of different compositions, wherein the interface between the layers is moderately graded in composition.

And wherein said multilayer film includes layers composed mainly of compounds of metal silicide with oxygen and/or nitrogen; or said multilayer film includes at least one layer composed mainly of molybdenum silicide oxynitride.

The applicant discusses the limitations of the prior art in that when exposure is made through a mask having an inclined boundary geometry, the contrast of the mask pattern at the boundary becomes blurred. Only a low contrast is provided upon exposure of a very fine pattern. And that a photomask with a mask pattern having a minimal line edge roughness can be formed when the interface of each layer with an adjacent layer is moderately graded in composition.

Claim 16 recites a phase shift mask blank comprising a substrate and a phase shift film thereon, said phase shift film having one side contacting the substrate and a surface

side remote therefrom, said phase shift film comprising a plurality of layers containing a metal and silicon in different compositional ratios which are stacked in such order that a layer having a higher etching rate is on the substrate side and a layer having a lower etching rate is on the surface side.

Westerman et al. teach a phase shift mask, comprising: a transparent substrate, a non-opaque etch stop layer disposed on said substrate, said etch stop layer selected from the group consisting of Cr-containing films; and a layer comprising a phase shifting material disposed on said etch stop layer.

And wherein the Cr-containing film has a different etch chemistry from the substrate and from the phase shifting material.

And wherein said phase shifting material layer is  $\text{MoSi}_{\text{sub.x}} \text{O}_{\text{sub.y}} \text{N}_{\text{sub.z}}$  having a thickness of about 50 nm to about 200 nm.

Westerman et al. also teach that the high etch selectivity of the phase shifter layer compared to the etch stop layer will allow the use of a more physical plasma etch process.

Angelopoulos et al. teach (see claims) the claimed invention including the claimed etch selectivity and composition.

Angelopoulos et al. teach an attenuating phase shift mask blank for use in lithography comprising: a substrate comprising a quartz or fluorinated quartz material; an etch stop layer deposited on said substrate comprising a metal selected from groups II, IV, V, transition metals, lanthanides and actinides, said etch stop layer exhibiting improved etch selectivity; a phase shifting layer disposed on said etch stop layer; and said phase shift mask blank being capable of producing a photomask with substantially 180.degree. phase shift and an optical transmission of at least 0.001% at a selected wavelength of

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<500 nm, wherein improved stability of said mask blank against irradiation of 157 nm photons is achieved.

And wherein the phase shifting film is formed by sputter deposition from two or more targets of different compositions using a technique selected from the group consisting of RF matching network, DC magnetron, AC magnetron, pulsed bipolar DC magnetron and RF diode.

### *Conclusion*

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Rosasco whose telephone number is (571) 272-1389. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. The Examiner's supervisor, Mark Huff, can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'S. Rosasco', with a stylized, sweeping flourish extending from the end.

S. Rosasco  
Primary Examiner  
Art Unit 1756

S. Rosasco  
10/10/06